National Transportation Safety Board
Aviation Accident Final Report

Location:	Sanford, FL	**Accident Number:**	MIA07LA068
Date & Time:	03/29/2007, 1616 EDT	**Registration:**	N877GA
Aircraft:	McDonnell Douglas DC-9-83 (MD-83)	**Aircraft Damage:**	Substantial
Defining Event:		**Injuries:**	1 Minor, 156 None
Flight Conducted Under:	Part 121: Air Carrier - Scheduled		

Analysis

The flight crew (FC) was in cruise flight when a master caution light illuminated indicating a loss of the right hydraulic system pressure and hydraulic fluid. The FC used the checklist to trouble shoot the system and attempted to manually extend the main and nose landing gear (NLG) using the alternate extension control lever. Both main gear extended and locked into place; however the NLG did not extend. The airplane was landed with the NLG in the retracted position. Initial inspection of the airplane revealed that a B-nut to the check valve on the rudder power hydraulic shut off valve, was separated from the valve resulting in a total loss of right hydraulic quantity and pressure. Examination of the hydraulic tube, including the B-nut and check valve, did not reveal any abnormalities. Examination of the cockpit revealed the landing gear handle was in the stowed position. A placard on the alternate landing gear extension lever stated, "Pull up forcibly Full Stroke." The airplane was placed on jacks and maintenance personnel successfully extended the nose landing gear. The alternate gear extension control system was also inspected and no defects were noted.

Probable Cause and Findings

The National Transportation Safety Board determines the probable cause(s) of this accident to be: The flight crew's failure to complete the checklist and adhere to airplane placards. Contributing to the accident was a separation of a B-nut on the rudder power hydraulic shut off valve for undetermined reasons.

Findings

Occurrence #1: WHEELS UP LANDING
Phase of Operation: EMERGENCY LANDING

Findings
1. (F) HYDRAULIC SYSTEM,FITTING - SEPARATION
2. (C) CHECKLIST - NOT COMPLIED WITH - FLIGHTCREW
3. (F) PROCEDURES/DIRECTIVES - NOT FOLLOWED - FLIGHTCREW

Factual Information

HISTORY OF FLIGHT

On March 29, 2007, about 1616 eastern daylight time, a McDonnell Douglas DC-9-83 (MD-83), N877GA, registered to Boeing Aircraft Holding Company and operated by Allegiant Air as flight 758, a 14 Code of Federal Regulations (CFR) Part 121 scheduled domestic passenger flight from Portsmouth, New Hampshire to Sanford, Florida, landed with the nose landing gear (NLG) retracted at the Orlando Sanford International Airport (SFB), Sanford, Florida. Visual meteorological conditions prevailed and an instrument flight rules flight plan was filed. The airplane received substantial damage. The airline transport-rated captain, airline transport-rated first officer (FO), 3 flight attendants (FA), and 151 passengers reported no injuries. One passenger received minor injuries and was taken to a local area hospital for observation and released. The flight originated from Portsmouth, New Hampshire, on March 29, 2007, at 1255.

The flight crew (FC) stated they were in cruise flight when a master caution light illuminated indicating a loss of the right hydraulic system pressure and hydraulic fluid. The FC used the checklist to trouble shoot the system. When the flight was about 10 miles from SFB the FC attempted to manually extend the main and nose landing gear (NLG) using the alternate extension control lever. Both main gear extended and locked into place; however the NLG did not extend. The FC communicated with the maintenance facilities in SFB and the airline's main base in Las Vegas, Nevada, for assistance in lowering the NLG, which was unsuccessful. The FC flew the airplane near the SFB control tower. The controller informed the FC that the NLG was in the retracted position and they could see fluid streaming from the aircraft. The FC continued to trouble shoot the system, and advised the passengers of the situation. The NLG would not extend after several attempts to lower the landing gear utilizing the alternate landing gear extension procedure. The captain declared an emergency, briefed the passengers, and landed on runway 9 with the NLG in the retracted position.

PERSONNEL INFORMATION

The captain, age 47, holds an airline transport pilot certificate with ratings for airplane multiengine land. He also holds a commercial pilot certificate with ratings for airplane single-engine land, and airplane instrument, which was issued on September 13, 2006. The captain holds a flight instructor certificate with ratings for airplane single-engine, airplane multiengine, and instrument airplane which was issued on December 19, 1994. The operator hired the captain on September 29, 2005, and he completed initial indoctrination training on October 7, 2005. Initial simulator qualification for the MD-80 was completed on November 22, 2005, and his initial operations check (IOE) was completed on December 11, 2005. He completed ground school for upgrade to captain in the MD-80 on September 6, 2006. Simulator training for the upgrade was completed on September 13, 2006, and his initial IOE/flight review, and line check as a captain was completed on October 30, 2006. His last simulator check before the accident was on March 7, 2007. He is type rated in the DC-9 and Lear jet. The captain has 7,145 total flight hours of which 2,996 hours are in the MD-80, and 105 hours as pilot-in-command. He holds a first-class medical certificate issued on May 22, 2007, without limitations or waivers. Review of the captain's training records revealed all pertinent aviation records pertaining to 14 CFR Part 121 airman competency and proficiency checks had been recorded as conducted.

The first officer (FO), age 37, holds an airline transport pilot certificate with ratings for

airplane multiengine land. He also holds a commercial pilot certificate with ratings for airplane single engine land, and airplane instrument which was issued on January 29, 2005. In addition, the FO holds a flight instructor certificate with ratings for airplane single-engine, airplane multiengine, and airplane instrument which was issued on March 21, 1999. The operator hired the FO on September 28, 2006. He completed initial indoctrination training and ground school for the MD-80 on October 26, 2006. Simulator training for qualification in the MD-80 was completed on November 7, 2006. He completed his initial IOE/ flight review on November 20, 2006 and was qualified as a FO on the MD-80. No additional simulator training or line checks were preformed before the accident. The FO is type rated in the Boeing 737, ATR-42 and ATR-72. The FO has 5,300 total flight hours of which 300 hours are in the MD-80. The FO holds a first-class medical certificate issued on March 14, 2007, without limitations or waivers. Review of the FO training records revealed all pertinent aviation records pertaining to 14 CFR Part 121 airman competency and proficiency checks had been recorded as conducted.

A review of records provided by the operator revealed that the No.1 FA was hired on October 1, 2005. The FA completed initial flight attendant training on October 6, 2005, and her last recurrent training on the MD-80 was on October 18, 2006. The No.2 FA was hired on October 26, 2006. The FA completed initial flight attendant training on October 31, 2006. The No.3 FA was hired on October 1, 2005. The FA completed initial flight attendant training on October 10, 2005, and his last recurrent training on the MD-80 was on September 21, 2006.

AIRCRAFT INFORMATION

The DC-9-83 (MD-83), serial number 53467 is a twin-engine, medium range, single isle commercial jet airplane with a tricycle landing gear. McDonald Douglas manufactured the airplane in 1994. The airplane has a seating capacity of 3 flight crew, 4 flight attendants, and 150 passengers. The airplane has two rear fuselage-mounted Pratt and Whitney JT8D-219, 21,700 pounds of thrust turbo fan engines, small, highly efficient wings, and a T-tail. The airplane is in a continuous airworthiness program and the last A check was completed on March 20, 2007. The total airframe time at the time of the A check was 22, 138.8 hours. The left engine had 26309.3 total flight hours at the time of the accident, and had flown 70.8 hours since the last A check. The last engine shop visit was on December 6, 2005. The right engine had 20, 982 total flight hours at the time of the accident, and had flown 70.8 hours since the last A check. The last engine shop visit was on November 30, 2005. The last gear retraction test before the accident and emergency gear extension test was completed on April 26, 2004.

METEOROLOGICAL INFORMATION

The 1628 SFB surface weather observation was: wind 070 degrees at 16 knots gusting to 21 knots, visibility 10 miles, few clouds at 4,500 feet, temperature 27 degrees Celsius, dew point temperature 13 degrees Celsius, and altimeter 30.14 inches of mercury.

FLIGHT RECORDERS

The Fairchild Model A-100 cockpit voice recorder (CVR) was forwarded to the National Transportation Safety Board Vehicle Recorder Division for analysis. The CVR did not sustain any heat or structural damage and audio information was successfully extracted. The recording consisted of three channels of audio information containing captain and copilot hot microphones, interphone audio, and one channel containing cockpit area microphone audio. The accident events were captured on the recording, the audio offered no additional

information that had not been obtained through other sources during the investigation. A CVR group was not formed and a transcript was not prepared.

The Honeywell model 980-47, 64-word solid-state flight data recorder (SSFDR) was forwarded to the Safety Board for analysis. The recorder was in good condition and data was successfully extracted. The data indicates that approximately 51.1 minutes after take off, the right hydraulic low status transitioned from "Not Low" to "Low," and 3 minutes 21 seconds later, the left hydraulic low status also transitioned from "Not low" to "Low." One second later, the left hydraulic status transitioned back to "Not Low," but the right hydraulic low status remained at "Low" for the rest of the recording. Approximately 19.7 minutes after the left hydraulic low status had transitioned back to "Not Low," it transitioned to "Low" again and remained at "Low" for 8 seconds before it transitioned back to "Not Low," and remained at "Not Low" for the remainder of the recording. About 2.1 hours after the last time the left hydraulic low status had transitioned back to "Not Low," the weight on wheels for the left and right main landing gear both indicated ground. The SSFDR data ended about 1.2 minutes later.

WRECKAGE AND IMPACT INFORMATION

The airplane came to a stop on runway 09 in a nose down attitude, and an emergency evacuation was completed. Examination of the airplane revealed structural damage at the 110 bulkhead extending aft to station 228, and between longerons 24L to 24 R. Initial inspection of the airplane by Federal Aviation Administration (FAA) inspectors revealed that a B-nut to the check valve on the rudder power hydraulic shut off valve (P/N 3772374-5503), was separated from the valve, resulting in a total loss of right hydraulic quantity and pressure. The hydraulic tube, P/N 7912641-969, including the B-nut and check valve, P/N 2C6540, were sent to the Safety Board Materials Laboratory in Washington, D.C. for analysis. The Safety Board metallurgist did not observe any abnormalities with the B-nut threads or the mating check valve threads.

Examination of the cockpit by the FAA inspectors revealed the landing gear handle was in the stowed position. A placard on the alternate landing gear extension lever states, "Pull up forcibly Full Stroke." The airplane was placed on jacks and maintenance personnel in the presence of the FAA inspectors extended the nose landing gear. Further examination of the airplane revealed no anomalies with the nose water spray installation, nose wheel lockout system, nose strut servicing, nose gear up lock release mechanism, general condition of the nose landing gear, wheel well, rigging, or the alternate landing gear extension control lever. The operator was issued a ferry permit by the FAA on April 2, 2007, and the airplane was flown to Tulsa, Oklahoma for further inspection and repair. The alternate gear extension control system was inspected on May 26, 2007, and no defects were noted. The FAA inspectors noted, "if the alternate landing gear extension handle were pulled correctly the handle would lock and not stow."

MEDICAL AND PATHOLOGICAL INFORMATION

Toxicology specimens were taken from the captain, FO and three FAs. The specimens were sent to the Central Drug System for analysis. The results were negative for all personnel for marijuana, cocaine, amphetamines, opiates, and PCP.

TEST AND RESEARCH

The Director of Flight Safety and Standards (DOFSS) for the operator stated there are three simulators for use in training company pilots. The facilities are located in Las Vegas, Nevada,

Miami, Florida, and Long Beach, California. The captain, and the FO were trained at the Los Angeles, LAS-729 facility, and the emergency gear extension practice is conducted as part of the initial FO simulator-training program. The captain satisfactorily completed the training on November 19, 2005, and the FO satisfactorily completed the training on November 4, 2006. The DOFSS could not provide any information specific to the force required to manually deploy the landing gear; however, based on recent manual gear extensions on all of the approved operator's simulators, the force required in his estimation is less than 15 pounds. In addition, during initial new hire training ground instructors supplement the "emergency gear extension lever" narrative in the system manual with an overhead presentation detailing the holding latch. The overhead material is supplemental with a discussion on the mechanics of manual gear extension, hydraulic bypass condition, gear doors, nose gear door down lock indicator, etc. During initial new hire simulator training, FOs are given a practical demonstration in the identification of an unsafe gear indication and subsequent manual gear extension procedures as provided in the MD-80 abnormal Quick Reference Handbook (QRH). He further stated that the operator does not provide any guidance relative to crewmembers being in the "standing position" to pull the handle.

According to the FAA, each simulator facility was initially qualified under the Advisory Circular 120-4b and FAA Order 8400.10. The Long Beach facility was manufactured by CAE Electronics LTD and qualified as a level C device on January 28, 1987. The last annual recurrent evaluation was conducted on June 6, 2006. The Miami facility was manufactured by Redifussion and qualified as a level C device on January 28, 1993. The last annual recurrent evaluation was conducted on January 9, 2006. The Las Vegas facility was manufactured by Singer-Link Miles and qualified as a level C device on June 1, 2001. The last annual recurrent evaluation was on July 11, 2006.

Arrangements were made to conduct a pull test on the alternate landing gear lever to the full up/extended position at all three simulator training facilities. The FAA was contacted by operator on June 11, 2007, stating that all the operator's simulator facilities were checked and they recorded approximately 40 pounds of pull during the alternate landing gear extension. The operator reported to the FAA that they conduct a functional check on the alternate landing gear extension every 36 months. The Aircraft Maintenance Manual states that the alternate landing gear extension is rigged not to exceed 75 pounds of pull.

ADDITIONAL INFORMATIUON

Review of the MD-80 Flight Crew Operating Manual Introduction states in General, "Volume I, ABNORMAL and EMERGENCY PROCEDURES HANBOOK contains emergency and abnormal procedures. Volume I is intended to provide the flight crew with a quick-reference checklist to EMERGENCY and ABNORMAL procedures contained in Volume II. Line items are identical to the line items for the emergency and abnormal procedures. However, the procedures are abbreviated by deleting explanatory material from the amplifies procedures.... In the Emergency Procedures, certain steps are shown with the line item enclosed in a box. Items in this identified in this manner are "recall" items that are classified as minimum immediate action items. Review of the placard located on the copilot side of the cockpit states, "Pull Up Forcibly Full Stroke."

To further enforce the placard Boeing Aircraft issued a temporary revision, Revision 2-434 to the Douglas Aircraft Company DC-9 Flight Crew Operating Manual, on October 15, 2007. The revision states, "Subject: LANDING GEAR-ABNORMAL OPERATION, CONDITION:

ALTERNATE GEAR EXTENSION REQUIRED AFTER RIGHT HYDRAULIC QUANITY AND PRESSURE LOSS....This Temporary Revision revises subject procedure, LANDING GEAR-ABNORMAL OPERATION, ALTERNATE GEAR EXTENSION REQUIRED AFTER RIGHT HYDRAULIC AND PRESSURE LOSS, by adding the word "forcibly" to actions for the use of the Emergency Landing Gear Extension Lever. This is being accomplished to ensure the lever is fully engaged." Identical revisions are scheduled for the Boeing 717, MD-90 and MD-80 Flight Crew Operating manuals.

The operator published a revision on June 4, 2007 pertaining to the landing gear system for the manual gear extension lever stating, PULL FULL UP Raise cover, pull emergency gear extension lever to full up position, and check holding latch is engaged. Once pulled, do not stow the lever unless a greater emergency exists."

Review of FAA surveillance records revealed the FAA conducted 107 enroute inspections, 661 airworthiness inspections, 245 operations inspections, 51 facility inspections, and 35 simulator checks on the operator from March 29, 2006, through March 29, 2007.

Pilot Information

Certificate:	Airline Transport; Commercial	**Age:**	47, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	Left
Other Aircraft Rating(s):	None	**Restraint Used:**	Seatbelt, Shoulder harness
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine; Instrument Airplane	**Toxicology Performed:**	
Medical Certification:	Class 1 Without Waivers/Limitations	**Last FAA Medical Exam:**	05/01/2007
Occupational Pilot:		**Last Flight Review or Equivalent:**	03/01/2007
Flight Time:	7145 hours (Total, all aircraft), 2996 hours (Total, this make and model), 2208 hours (Pilot In Command, all aircraft), 171 hours (Last 90 days, all aircraft), 76 hours (Last 30 days, all aircraft), 10 hours (Last 24 hours, all aircraft)		

Co-Pilot Information

Certificate:	Airline Transport; Commercial	**Age:**	37, Male
Airplane Rating(s):	Multi-engine Land; Single-engine Land	**Seat Occupied:**	
Other Aircraft Rating(s):		**Restraint Used:**	
Instrument Rating(s):	Airplane	**Second Pilot Present:**	Yes
Instructor Rating(s):	Airplane Multi-engine; Airplane Single-engine	**Toxicology Performed:**	
Medical Certification:	Class 1 Without Waivers/Limitations	**Last FAA Medical Exam:**	03/01/2007
Occupational Pilot:		**Last Flight Review or Equivalent:**	11/01/2006
Flight Time:	5300 hours (Total, all aircraft), 300 hours (Total, this make and model), 2586 hours (Pilot In Command, all aircraft), 160 hours (Last 90 days, all aircraft), 71 hours (Last 30 days, all aircraft), 6 hours (Last 24 hours, all aircraft)		

Aircraft and Owner/Operator Information

Aircraft Make:	McDonnell Douglas	**Registration:**	N877GA
Model/Series:	DC-9-83 (MD-83)	**Aircraft Category:**	Airplane
Year of Manufacture:		**Amateur Built:**	No
Airworthiness Certificate:	Transport	**Serial Number:**	53467
Landing Gear Type:	Retractable - Tricycle	**Seats:**	157
Date/Type of Last Inspection:	03/01/2007, Continuous Airworthiness	**Certified Max Gross Wt.:**	139500 lbs
Time Since Last Inspection:	976 Hours	**Engines:**	2 Turbo Fan
Airframe Total Time:	22139 Hours	**Engine Manufacturer:**	Pratt & Whitney
ELT:	Not installed	**Engine Model/Series:**	JT8D-219
Registered Owner:	Boeing Aircraft Holding Company	**Rated Power:**	21700 lbs
Operator:	Allegiant Air LLC	**Operating Certificate(s) Held:**	Flag carrier (121)
Operator Does Business As:		**Operator Designator Code:**	WXOA

Meteorological Information and Flight Plan

Conditions at Accident Site:	Visual Conditions	**Condition of Light:**	Day
Observation Facility, Elevation:	SFB, 55 ft msl	**Distance from Accident Site:**	
Observation Time:	1628 EDT	**Direction from Accident Site:**	
Lowest Cloud Condition:	Few / 4500 ft agl	**Visibility**	10 Miles
Lowest Ceiling:	None	**Visibility (RVR):**	
Wind Speed/Gusts:	16 knots / 21 knots	**Turbulence Type Forecast/Actual:**	/
Wind Direction:	70°	**Turbulence Severity Forecast/Actual:**	/
Altimeter Setting:	30.14 inches Hg	**Temperature/Dew Point:**	27°C / 13°C
Precipitation and Obscuration:	No Obscuration; No Precipitation		
Departure Point:	Portsmouth, NH (PSM)	**Type of Flight Plan Filed:**	IFR
Destination:	Sanford, FL (SFB)	**Type of Clearance:**	IFR
Departure Time:	1255 EDT	**Type of Airspace:**	

Airport Information

Airport:	Orlando Sandford Intl Airport (SFB)	**Runway Surface Type:**	Asphalt
Airport Elevation:	55 ft	**Runway Surface Condition:**	Dry
Runway Used:	9L	**IFR Approach:**	ILS
Runway Length/Width:	9600 ft / 150 ft	**VFR Approach/Landing:**	Straight-in

Wreckage and Impact Information

Crew Injuries:	5 None	**Aircraft Damage:**	Substantial
Passenger Injuries:	1 Minor, 151 None	**Aircraft Fire:**	None
Ground Injuries:	N/A	**Aircraft Explosion:**	None
Total Injuries:	1 Minor, 156 None	**Latitude, Longitude:**	28.768333, -81.237500

Administrative Information

Investigator In Charge (IIC):	Jose Obregon	**Report Date:**	09/26/2008
Additional Participating Persons:	Charles Bleiberg; FAA/FSDO; Orlando, FL James E Talay; Boeing; Long Beach, CA James Carr; Allegiant Air; Las Vegas, NV		
Publish Date:			
Investigation Docket:	NTSB accident and incident dockets serve as permanent archival information for the NTSB's investigations. Dockets released prior to June 1, 2009 are publicly available from the NTSB's Record Management Division at pubinq@ntsb.gov, or at 800-877-6799. Dockets released after this date are available at http://dms.ntsb.gov/pubdms/.		

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The Independent Safety Board Act, as codified at 49 U.S.C. Section 1154(b), precludes the admission into evidence or use of any part of an NTSB report related to an incident or accident in a civil action for damages resulting from a matter mentioned in the report. A factual report that may be admissible under 49 U.S.C. § 1154(b) is available here.